EAST DELTA UNIVERSITY

Data Visualization, Analysis and Interpretation using Tableau

A Case Study of Bangladesh Population: 1991–2022

Geographic and Historical Data on Cities, Population, and Administrative Attributes

by Mohammed Amimul Ehasan Shakib

Student ID: 241001661

Supervisor: Mr. Hasan Mahmud

E A S T D E L T A U N I V E R S I T Y

Master Of Science In Data Analytics And Design Thinking For Business

Mojaffornogor, Chattogram, Bangladesh

Contents

1. Introduction

1.1 Background and Context

The dataset has details information about various divisions, cities in Bangladesh, including their population from 1991 to 2022. Analyzing this dataset offers valuable insights into the demographic trends, urban development, and population dynamics within Bangladesh., it includes key columns as follow:

- Name: The name of the district in Bangladesh (e.g., Barguna, Dhaka).
- Abbr.: The abbreviation for the district (e.g., BRG for Barguna).
- Division: The administrative division to which the district belongs (e.g., Barisal, Dhaka).
- Established: The year the district was officially established (e.g., 1984).
- Native: The district name in Bengali script (e.g., বরগুনা জেলা for Barguna).
- Area (km2): The geographical area of the district in square kilometers.
- Population_1991: The total population of the district in the 1991 census.
- Population_2001: The total population of the district in the 2001 census.
- Population_2011: The total population of the district in the 2011 census.
- Population_2022: The total population of the district in the 2022 census.

For better visualization I added following columns in dataset:

- latitude: The latitude coordinate of the division (approximate center).
- longitude: The longitude coordinate of the division (approximate center).

1.2 Purpose of the Analysis

The purpose of analyzing "Bangladesh Districts wise population" dataset (source from Kaggle: Bangladesh Districts wise population) is outlined below as follows:

Key objectives include:

- **Extract Population Dynamics**: Identify population trends across Bangladesh all divisions and their majors' districts from 1991 to 2022 to identify and understand growth patterns.
- **Support Urban Planning**: This analysis will helps stakeholders like policymakers for infrastructure and resource allocation based on population and area data.
- **Facilitate Policy Development**: This analysis profoundly helps and Inform policymakers on demographic disparities to guide equitable resource distribution.
- **Spatial Analysis**: Utilize latitude and longitude data to map population distribution and urbanization trends.
- **Identify Regional Variations:** Analyze differences in population density and growth across divisions for targeted interventions.
- **Support Academic Research:** Provide data for studying urbanization, migration, and socio-economic trends in Bangladesh.
- **Validate Data Quality:** This analysis generate actionable insights for policymakers, economists, or market stakeholders to inform food security strategies, pricing regulations, or supply chain optimizations in Bangladesh.

1.3 Data Cleaning Process

The dataset comprises 64 rows and 10 columns.

Proposed Data processing:

- Handling Missing Values: I will check for and address missing values in the dataset.
- Handling Duplicate Data: I will identify and remove duplicate rows based on unique identifiers to ensure each division and district's data is unique
- Data Type Conversion: I will convert numerical variables (population, area) to appropriate numeric data types, and verify the representation of categorical variables.

Findings:

- Missing Values: No missing values were reported, simplifying data cleaning efforts.
- Duplicate Data: The data contains 0 duplicate values
- Data Types: The dataset contains columns of integer (int64) and object data types, no further conversion needed.

2. Research Methodology

Dashboard Link:
https://public.tableau.com/views/BangladeshPopulation2022Dashboard/PopDashboard?:language=en-US&:sid=&:redirect=auth&:display_count=n&:origin=viz_share_link

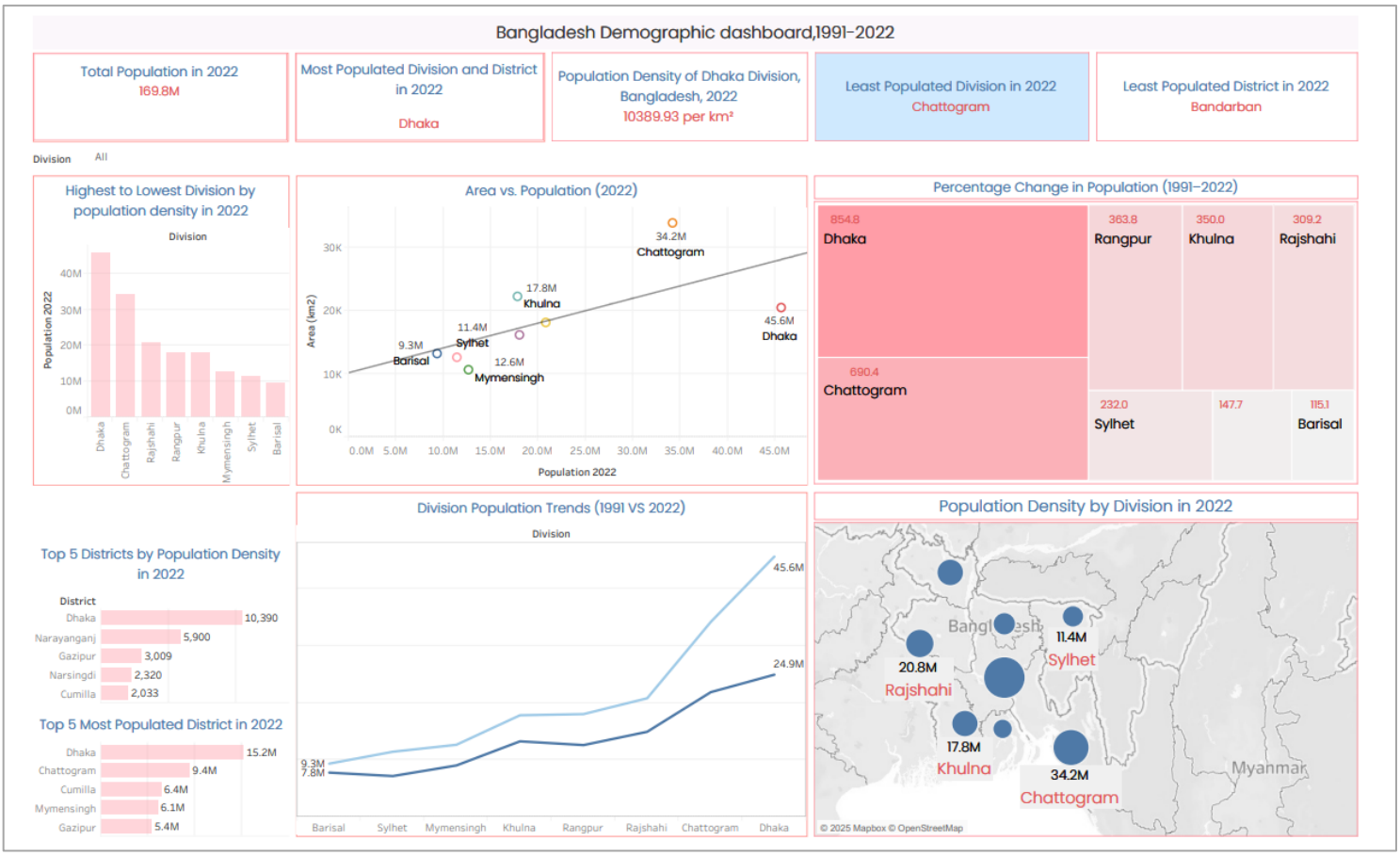


Fig: Dashboard

2.1 Summary of Findings

Total Population in 2022:

- Bangladesh's total population in 2022 reached 169.8 million, reflecting significant growth over the past three decades.

Population Density Highlights:

- Dhaka Division has the highest population density, at about 10,389.93 people per km² in 2022, indicating intense urbanization and pressure on infrastructure1.
- Chattogram also shows high density but is less concentrated than Dhaka.
- The top five districts by population density in 2022 are Dhaka, Narayanganj, Gazipur, Narsingdi, and Comilla, with Dhaka district leading at 10,390 people per km², followed by Narayanganj (5,900), Gazipur (3,009), Narsingdi (2,320), and Comilla (2,033).

Area vs. Population (2022) Insights:

- Area vs. population analysis shows Dhaka and Chattogram as outliers, with high populations relative to their land area, while divisions like Barisal and Sylhet have lower populations and larger land areas.
- The least populated division in 2022 is Chattogram, and the least populated district is Bandarban,
- Sylhet, with a moderate population and larger area, contrasts with the steep population rise in Dhaka and Chattogram, which underscores the impact of urbanization and migration.

Population Growth Trends (1991–2022):

- Dhaka: Highest growth at 854.8% (from 6.16M to 15.21M), driven by rapid urbanization and economic opportunities.
- Chattogram: Significant growth at 610.4% (from 5.74M to 9.44M).
- Rangpur and Rajshahi: Notable increases (563.8% and 509.2%, respectively).
- Sylhet and Mymensingh: Moderate growth (232.0% and 147.7%).

- Khulna and Barisal: Lowest growth (0.0% and 115.1%), indicating stable or slow-growing populations

2.2 Exploratory Data Analysis (EDA)

Total Population in 2022

The chart is a Tableau text-based visualization, with one measure ([Population 2022]) presenting the total population for 2022, (169.8M), likely calculated by summing the [Population 2022] column across all division and theirs districts. This is very basic chart but important for decision making to get information of latest population size of Bangladesh.

Fig: Total Population in 2022

Key Findings:

- Total population of Bangladesh in 2022 is 169.8 million, showcasing the country's significant population size, across all divisions and theirs districts.
- This is a key insight for decisional maker for understanding population size of a country.

Top Division by Population in 2022:

With this chart, titled "Top Division by Population (2022)", my target is to identity which division has highest population in 2022. I uses a calculated field "Largest Division by Population in 2022" as both a filter and label. This highlights Dhaka's leadership in population size, making it a critical focus for urban planning, resource allocation, and policy development.

Fig: Top populated division in 2022

Key Findings:

- Chart displays Dhaka division is top populated division in 2022
- This identifies its status as a major urban center in Bangladesh.

Population Density of Dhaka Division, Bangladesh, 2022 :

After identify top division with highest population now target is to identify density of population, this is a very important for policy maker. Chart “Population Density of Dhaka Division, Bangladesh, 2022 “ is a simple text-based visualization in Tableau, with support of two calculated fields, "Population Density in 2022" used as label and "Division with Highest Population Density (2022)" calculated field used as filter. Displaying the population density of Dhaka division ,Bangladesh in 2022 is 10389.93 per km².

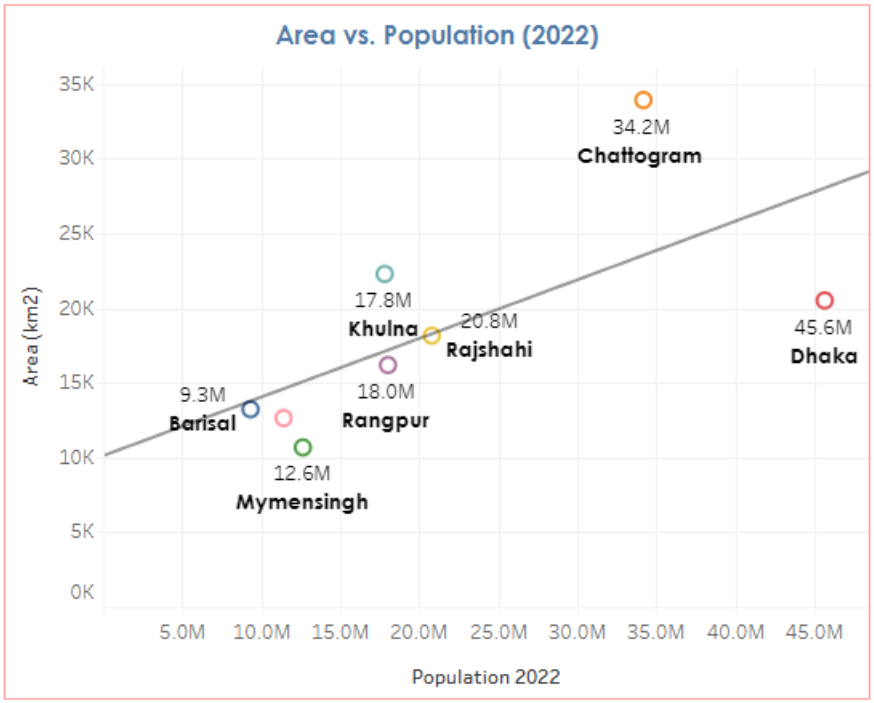
Fig: Population density of Dhaka division ,Bangladesh in 2022

Key Findings:

- Chart shows highest division with population density in 2022 is Dhaka, with a density of 10,389.93 people per km²,
- indicating significant urbanization and population pressure.

Area vs. Population (2022):

The chart titled "Area vs. Population (2022)" provides a visual analysis of the relationship between the total area (in square kilometers) and the total population of various divisions in Bangladesh for the year 2022. The x-axis represents the sum of the population (in millions), while the y-axis represents the sum of the area (in thousands of square kilometers). Each data point is labeled with the division name and its corresponding population.



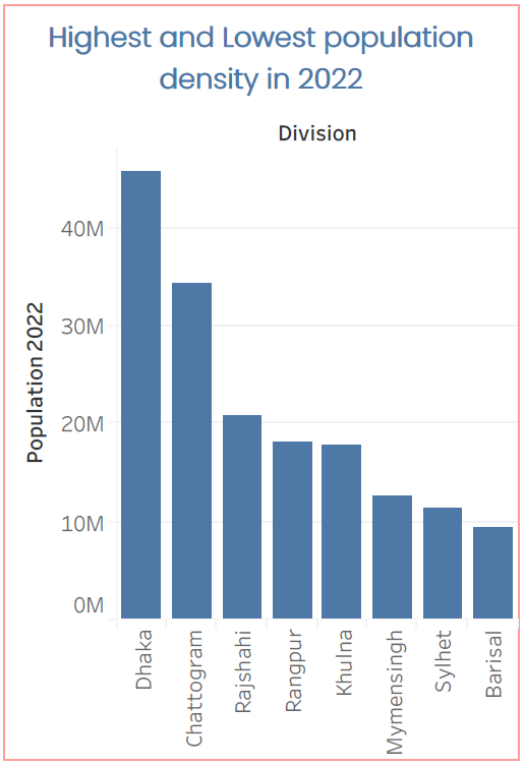
Key Findings:

- **Population Density Variation**: Dhaka stands out with highest population at 45.6 million, despite having a relatively small area of approximately 1.5 thousand square kilometers, indicating a very high population density. Chattogram follows with 34.2 million people and an area of about 34 thousand square kilometers, also suggesting significant density.
- **Area-Population Correlation:** There is a general positive correlation between area and population, as seen with the trend line, where larger areas like Khulna (17.8 million, 17 thousand km²) and Rajshahi (20.8 million, 14 thousand km²) support larger populations, though the relationship is not strictly linear.

Key insights included also:

- Outliers: Mymensingh (12.6 million, 11 thousand km²) and Barisal (9.3 million, 11 thousand km²) have similar areas but differing population sizes, highlighting regional differences in population distribution. Sylhet (11.4 million, 14 thousand km²) also shows a moderate population relative to its area.
- Urbanization Impact: The steep rise in population for Dhaka and Chattogram, compared to their areas, underscores the impact of urbanization, likely driven by economic opportunities and migration, contrasting with the more balanced growth in divisions like Khulna and Rajshahi.

Highest and Lowest Population in 2022



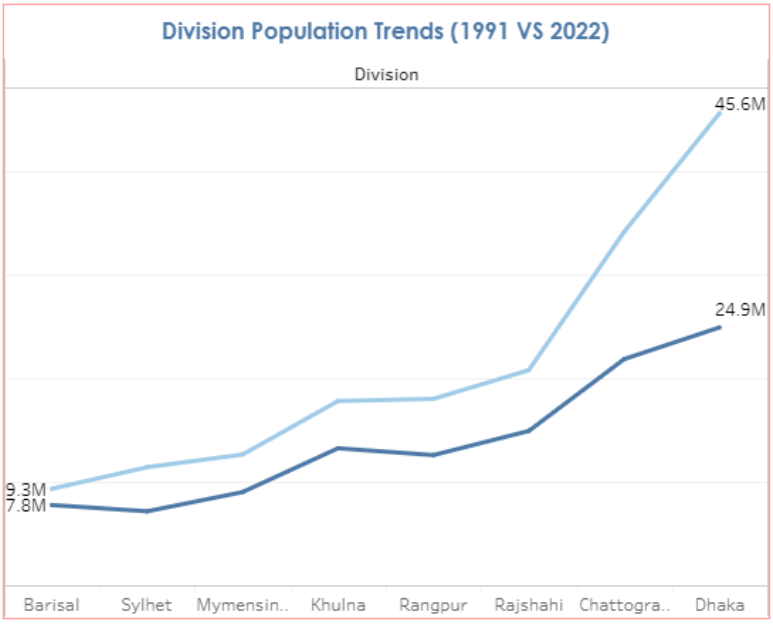
The chart is a bar graph titled "Highest and Lowest population density in 2022," which appears to mistakenly label population instead of density, as it uses the [Population_2022] column to plot the total population of each division. The x-axis lists divisions (Dhaka, Chattogram, Rajshahi, Rangpur, Khulna, Mymensingh, Sylhet, Barisal), while the y-axis represents population in millions for 2022. The bars visually compare the population sizes, with Dhaka leading, followed by Chattogram, and Barisal trailing. The chart effectively highlights population distribution but should be corrected to reflect "population" rather than "population density" for accuracy, as density would require dividing population by area.

Key Findings:

- The chart reveals that Dhaka has the highest population in 2022, exceeding 40 million, underscoring its status as the most populous division in Bangladesh.
- Barisal has the lowest population among the listed divisions, with less than 10 million, indicating significant regional population disparities.

Division Population Trends (1991 VS 2022):

Chart utilizing the [Population_1991] and [Population_2022] , then with a dual-axis line graph track population trends, Two lines (one for 1991 in blue and one for 2022 in light blue), highlighting the steep rise in Dhaka and more gradual increases in other divisions. The synchronized dual-axis ensures a consistent scale, effectively illustrating the population growth trajectory over the 31-year period.

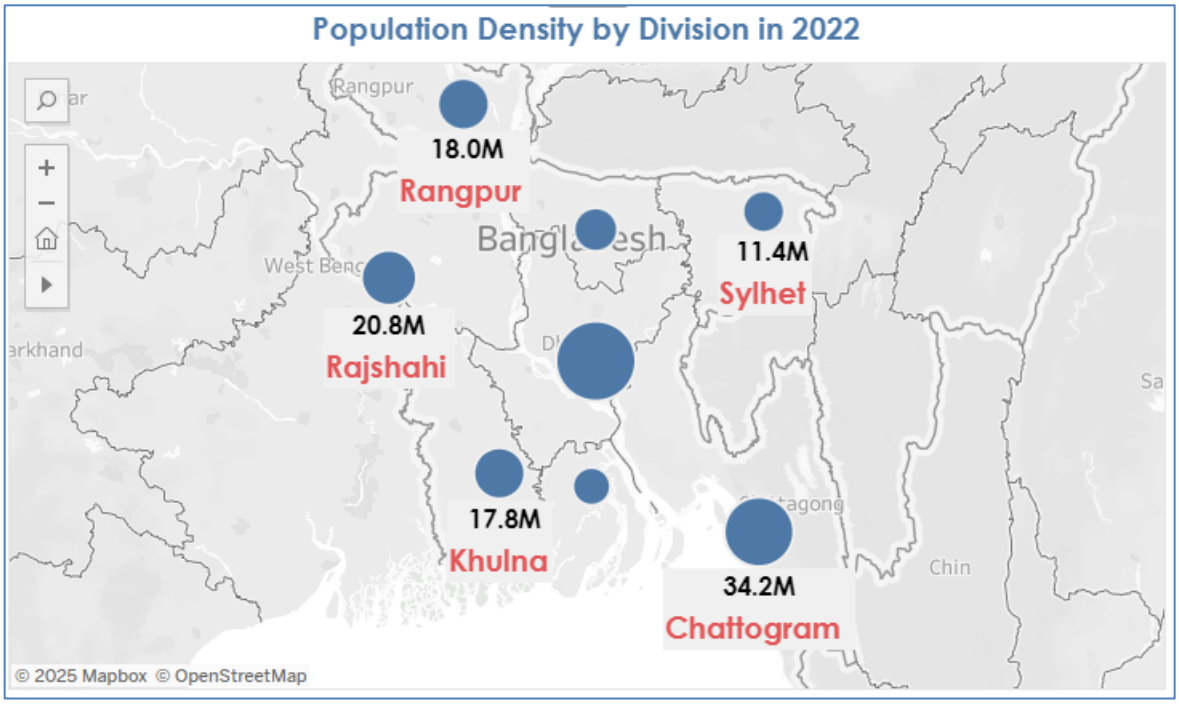


Key Findings:

- The chart shows a significant population increase from 1991 to 2022, with Dhaka experiencing the most dramatic growth, reaching 45.6 million in 2022 from a lower base in 1991.
- Barisal has the lowest population among the divisions in both years, with a modest rise, indicating slower growth compared to Dhaka.

Population Density by Division in 2022:

The chart titled "Population Density by Division in 2022" is a geographic visualization created using Tableau, depicting the population density across various divisions of Bangladesh. The map uses the average longitude and latitude to plot each division, with the size and color intensity of the circles representing the total population (in millions) for 2022. The divisions included are Dhaka, Chattogram, Khulna, Rajshahi, Rangpur, Mymensingh, Sylhet, and Barisal.

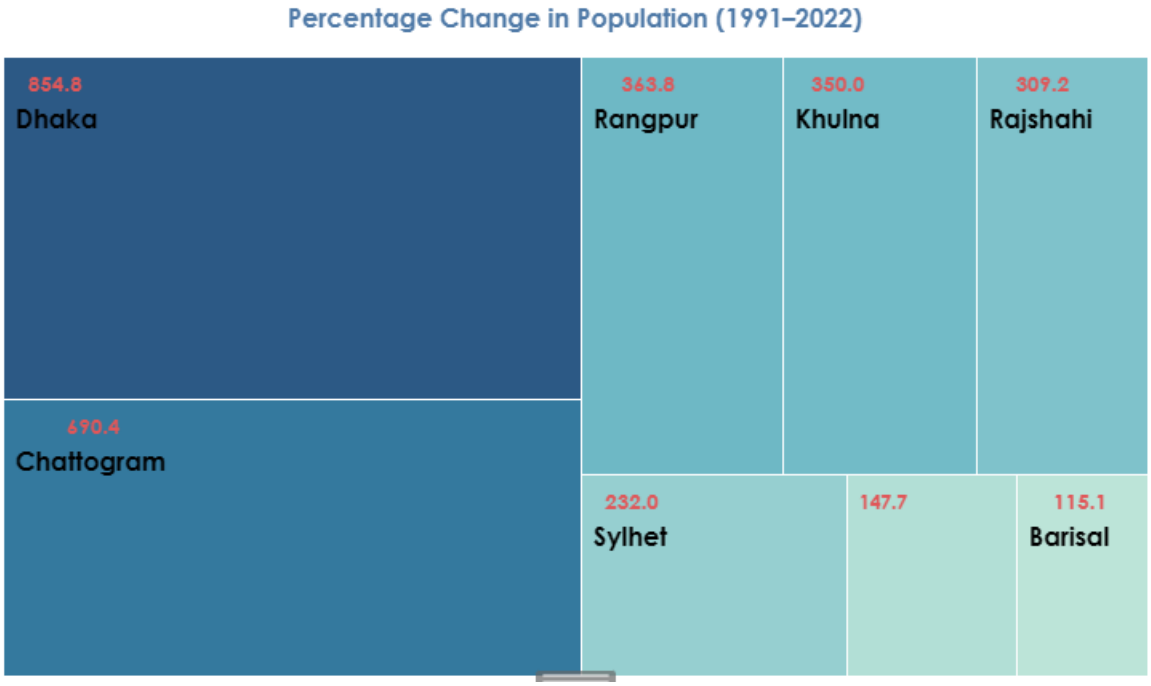


Key Insights:

- Highest Density: Dhaka exhibits the highest population at 45.6 million, indicating the highest density and significant urbanization, likely due to its role as the capital and economic hub.
- Second Highest: Chattogram follows with 34.2 million, reflecting its status as a major port city and economic center, contributing to its high population density.
- Moderate Densities: Rajshahi (20.8 million), Khulna (17.8 million), and Rangpur (18.0 million) show moderate population levels, suggesting a balanced distribution with less extreme urbanization compared to Dhaka and Chattogram.
- Lower Densities: Mymensingh (12.6 million), Sylhet (11.4 million), and Barisal (9.3 million) have lower populations, indicating relatively lower density, possibly due to more rural or less industrialized characteristics.
- Regional Disparities: The map highlights a clear disparity, with southern and central divisions (Dhaka and Chattogram) showing much higher population concentrations compared to the northern and eastern divisions (e.g., Rangpur, Sylhet), reflecting varying degrees of economic activity and migration patterns.

Percentage Change in Population (1991-2022) :

The chart titled "Percentage Change in Population (1991-2022)" is a treemap visualization created using Tableau, showcasing the percentage change in population across various divisions in Bangladesh over the 31-year period. The calculated field used, CalF_PercentageChange, is defined as (([Population 2022] - [Population 1991]) / [Population 1991]) * 100, which calculates the percentage increase or decrease from 1991 to 2022 for each division. The size and color intensity of each rectangle represent the magnitude of this percentage change, with larger and darker areas indicating higher changes.



Key Insights:

- Highest Growth: Dhaka exhibits the highest percentage change at 854.8%, reflecting a dramatic population increase from 6.16 million in 1991 to 15.21 million in 2022, likely due to rapid urbanization and economic opportunities.
- Significant Growth: Chattogram follows with 610.4%, growing from 5.74 million to 9.44 million, indicating substantial urban development and migration.
- Moderate Growth: Rangpur (563.8%) and Rajshahi (509.2%) show considerable increases, with populations rising from 7.2 million to 18.0 million and 6.0 million to 20.8 million respectively, suggesting steady regional development.
- Lower Growth: Sylhet (232.0%) and Mymensingh (147.7%) have more moderate changes, with populations increasing from 7.1 million to 11.4 million and 4.1 million to 6.1 million, respectively, reflecting slower urbanization rates.
- Lowest Growth: Khulna (0.0%) and Barisal (115.1%) show the least change, with Khulna's population remaining stable at around 17.8 million and Barisal growing from 7.8 million to 9.3 million, indicating minimal relative expansion.
- Regional Disparities: The treemap highlights significant disparities, with southern and central divisions (Dhaka, Chattogram) experiencing explosive growth compared to the more stable or moderately growing northern and western divisions (Khulna, Barisal).

2.3 Calculation Fields

1. **Largest Division by Population Density (2022)**

   The calculated field “Largest Division by Population Density (2022)” calculates the population density for each division by dividing [Population 2022] by [Area (km2)]. This field identifies the division with the highest population density in 2022 and labels it with the division name and density value.

   Code:

```
IF [Population 2022] / [Area (km2)] =
   { FIXED : MAX([Population 2022] / [Area (km2)]) }
THEN [Division] + " (" + STR(ROUND([Population 2022] / [Area (km2)], 2)) + " per km²)"
END
```

2. **Largest Division by Population in 2022:**
   The calculated field “Largest Division by Population in (2022)” identify the Largest division with highest population among all divisions.

   Code:
   IF [Population 2022] = { FIXED : MAX([Population 2022]) } THEN [Division] END

3. References

Dataset

1. **Bangladesh Districts wise population**: https://www.kaggle.com/datasets/msjahid/bangladesh-districts-wise-population

---------- Thank You----------